

### **Support for the Amendments to the Specification and Claims**

The specification was amended to more clearly describe two of the fluorinated acids, namely ammonium hydrogen difluoride, and potassium hydrogen difluoride.

Support for the use of "aqueous solution" can be found at page 8, lines 25-27.

### **The Invention**

The subject invention relates to foundry binder systems, which cure in the presence of gaseous sulfur dioxide and an oxidizing agent. The binder comprises an epoxy resin, a fatty acid, certain aqueous solutions of fluorinated acids having a hydrogen bonded to a fluorine atom. The binders are free of an ethylenically unsaturated monomer or polymer.

It has been found that addition of these fluorinated acids to an acrylate-free binder provides foundry shapes that have better tensile strength development and humidity resistance than foundry shapes made with binders that do not contain the fluorinated acid. Tests have also shown that the foundry shapes, made with these binders, have better tensile strength development and humidity resistance than those made with similar binders containing an acrylate and no fluorinated acid. This is beneficial in the casting of both light metal (e.g. aluminum) and ferrous parts.

Another advantage of the binder, because it is acrylate-free, is that all of the components of the binder can be sold and used in one package. This simplifies the customer's binder storage and handling operations.

The foundry binders are used for making foundry mixes. The foundry mixes are used to make foundry shapes, such as cores and molds, which are used to make metal castings.

### **DISCUSSION OF EXAMINER'S OFFICE ACTION**

#### **Claim Rejections - 35 USC § 112, second paragraph**

The following is a quotation of the second paragraph of 35 U.S.C. §112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the Applicants regards as their invention.

**Claims 1-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

The terms "effective amount and parts" in claim 1 are relative terms which render the claims indefinite. The terms "effective amount and parts" are not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The term "parts" does not refer to a specific unit of measurement, such as weight or moles.

Claim 2 incorrectly depends upon itself so can not be understood. Claims 3-12 depend directly or indirectly upon claim 2.

### **Applicants' Response**

Applicants' have corrected this mistake.

### **Claim Rejections - 35 USC § 103 (a)**

The following is a quotation of 35 U.S.C. §103(a), which forms the basis for all obviousness rejections Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

### **Legal Standard of Obviousness**

*Graham V. John Deere*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966) outlined the approach that must be taken when determining whether an invention is obvious. In *Graham*, the Court stated that a patent may not be obtained if the subject matter would have been obvious at the time the invention was made to a person having ordinary skill in the art, but emphasized that nonobviousness must be determined in the light of inquiry, not quality. Approached in this light, §103 permits, when followed realistically, a more practical test of patentability. In accordance with *Graham*, three inquiries must be made in determining whether an invention is obvious:

- (1) The scope and content of the prior art are to be determined.
- (2) The differences between the prior art and the claims at issue are to be ascertained.
- (3) The level of ordinary skill in the pertinent art resolved.

Against this background, the obviousness or nonobviousness of the subject matter is determined. Secondary considerations, such as commercial success, long felt but unsolved needs, failure of others, etc., can be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

In conjunction with the interpreting 35 U.S.C. §103 under *Graham*, the initial burden is on the Examiner to provide some suggestion of the desirability of doing what the inventor did, i.e. the Examiner must establish a *prima facie*

case of obviousness. To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention, or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.

To establish a *prima facie* case of obviousness, three basic criteria must be met:

1. There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings.
2. There must be a reasonable expectation of success.
3. The prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on Applicants' disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q. 2d 1438 (Fed. Cir. 1991). See MPEP § 2143 - § 2143.03 for decisions pertinent to each of these criteria.

### **The person of ordinary skill in the art (TPOSA)**

Determining the level of ordinary skill in the art is often the most difficult of the *Graham* inquiry in an *ex parte* proceeding. In an *ex parte* proceeding, the Examiner and Applicants typically do not have testimony or survey evidence on this issue. They must rely on the experience of the Examiner and Applicants to resolve this issue.

For this invention, Applicants submit that the relevant art relates to foundry binders. It is assumed that TPOSA working in this field typically had a degree in chemistry or at least a working knowledge of the basic chemistry in the field related to foundry binders. Applicants assume that TPOSA was aware of the references cited by the Examiner.

Applicants believe these are the circumstances that were influencing TPOSA at the time Applicants made their invention. This information, practical knowledge, and costs influenced TPOSA in solving problems. The foundry binder industry was a mature industry and the field was very crowded. Based upon their experience in the art, Applicants submit that technological improvements in this field were gradual and only incremental.

**Claims 1-12 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Woodson, US Patent No. 4806576 in view of Moore, US Patent No. 3107403 and Kottke et al, US Patent No. 3145438.**

Woodson discloses curable epoxy resin compositions comprising acid curable epoxy resins and a minor amount of an oxidizing agent which is capable of reacting with sulfur dioxide to form a catalyst for curing said epoxy resin. These curable epoxy resin compositions are useful in preparing formed, shaped, filled bodies such as abrasive articles, foundry, cores and molds. Suitable epoxy resins for purposes of the invention include diglycidyl ethers of bisphenol A and the diglycidyl ethers of other bisphenol compounds such as bisphenol B, F, G and H. Another class of epoxy resins useful in the patented invention is the novolacs, particularly the epoxy cresol and epoxy phenol novolacs. The epoxides are used in an amount of 30-50 pbw of the composition. A suitable oxidizing agent for use with the epoxy resins of the patented invention is cumene hydroperoxide. The sulfur dioxide used to cure the epoxy resins of the invention may be presented in a stream of a carrier gas. See col. 6, lines 12-62. The cold box process for foundry preparation is disclosed by patentee. The Woodson reference differs from applicant's invention in that it fails to teach the inclusion of fluorinated acid.

Moore discloses molding cores prepared from polymerizable epoxide binders. Patentee also discloses a method for the rapid production of the molded cores wherein a filler and an epoxide are combined in a mold, tamped and subsequently treated with a polymerization catalyst. Suitable catalysts for the invention include strong Lewis acids such as boron

trifluoride. This catalyst is considered to be a fluorinated acid. It is also a gas. See col. 1, line 9 through col. 2, line 59. Also see col. 4, line 23 through col. 8, line 68.

Kottke et al discloses a method for making core and molding sands with organic binders which can be cured quickly in the absence of heat. Patentee indicates that epoxy resins may be used as binders and boron trifluoride may be used as an acid catalyst. See col. 1, line 10 through col. 3, line 15.

It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to use the boron trifluoride acid catalyst of Moore or Kottke et al as a fluorinated acid catalyst to speed the cure of the Woodson epoxy resins in the absence of heat, since Woodson discloses that the dioxide used to cure the epoxy resins of the invention may be presented in a stream of a carrier gas and the boron trifluoride acid catalyst of Moore or Kottke et al are in gas form.

### **Applicants' Response**

The Examiner concedes that Woodson, the primary reference, differs from Applicants' invention because the Woodson binder does not contain a fluorinated acid. But there is another difference between the Woodson binder and Applicants' binder that the Examiner does not mention. The Woodson binder contains an ethylenically unsaturated monomer and/or polymer, while Applicants' binder does not contain this component. The reasons and advantages associated with eliminating this component were discussed previously. Because it is acrylate-free, all of the components of the binder can be sold and used in one package. This simplifies the customer's binder storage and handling operations.

The addition of an aqueous solution of the specified fluorinated acids to an acrylate-free binder provides molds and cores that have better tensile strength development and humidity resistance than foundry shapes made with binders that do not contain the fluorinated acid. The molds and cores made with these binders have better tensile strength development and humidity resistance than those made with similar binders containing an acrylate and no fluorinated acid. This is beneficial in the casting of both light metal (e.g. aluminum) and ferrous parts.

The claims have been amended to limit the fluorinated acid to aqueous solutions of certain compounds. These compounds have a hydrogen atom directly bonded to a fluorine atom and can be dissolved in water. They are added to the binder to improve tensile strengths of the molds and cores made with the binder and improve the humidity resistance of the molds and cores. They do not function as catalysts; otherwise they would cause the binder to cure and it would not be storage stable.

The secondary references, Moore and Kottke, do not teach or suggest to TPOSA how to modify Woodson's binder to derive Applicants' binder. The Lewis acids listed in both Moore and Kottke are used as curing catalysts for the binder and are in the form of gases. They do not come into contact with the binder prior to curing the foundry shape made with the binder. And if they did, the binder would be unstable because it would react with curing catalyst. The aqueous solutions of the defined fluorinated acids, which are added to Applicants' binder, are liquid do not react with the binder after it is formulated, stored, and sold.

In view of these differences and the benefits achieved by the invention, Applicants submit that their invention would not have been obvious to TPOSA at the time the invention was made. The prior art would not have motivated TPOSA to derive Applicants' invention and there are no teachings or suggestions in the prior that would lead TPOSA to reasonably expect the improvements, which result from using Applicants' invention.

## **Conclusion**

In view of the differences between Applicants' invention and the prior art, Applicants submit that claims 1-12 were not obvious to TPOSA at the time the invention was made. Furthermore, Applicants submit that their invention could only be derived from the references by the use of "hindsight", i.e. by knowing what Applicants' invention was in advance from Applicants' disclosure, and then *ex post facto* reconstructing Applicants' invention from the prior art after a thorough search. The prior art does not lead TPOSA to Applicants' invention.

The Examiner knew, from Applicants' own disclosure, what Applicants' invention was when the patentability search was conducted. It is not easy to separate what the Examiner knew from the Applicants disclosure and what the prior art suggests. By the nature of the examination, the Examiner makes his determination of obviousness *ex post facto*. TPOSA does not have the advantage of knowing what the invention is, and must derive the invention from his insight as applied to the prior art. Applicants urge the Examiner to keep this in mind when deciding whether

Applicants' invention is obvious. Applicants submit that it would take more than ordinary skill by TPOSA to derive Applicants' invention from the prior art at the time the invention was made.

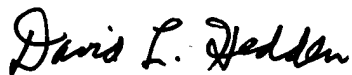
In this regard, Applicants believe the discussion in *In re Kotzab*, 55 U.S.P.Q. 2d 1313 (Fed. Cir. 2000) at page 1317 is relevant:

A critical step in analyzing the patentability of claims pursuant to section 103 (a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. See *Dembiczak*, 175 F.3d at 999, 50 USPQ2d at 1617. Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher."<sup>1</sup> *Id.* (quoting *W.L. Gore & Assocs., Inc. v Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303,313 (Fed. Cir. 1983).

Applicants submit that in this situation, there was no motivation to derive Applicants' invention or reasonable expectation that the benefits of using the invention would result. Therefore, Applicants submit that, unless "hindsight" is used, their invention is not obvious.

Applicants submit that the application is now in condition for allowance and respectfully request a notice to this effect. If the Examiner believes further explanation of Applicants' position is needed, Applicants' attorney will discuss this matter over the telephone or visit the Examiner personally if this may be useful.

Respectfully submitted,



David L. Hedden  
Attorney for Ashland Inc.  
Registration No. 29,388

Ashland Inc.  
P.O. Box 2219  
Columbus, Ohio 43216

Phone: (614) 790-4265  
Fax: (614) 790-4268  
e-mail: dlhedden@ashland.com

---

<sup>1</sup> Underlining added for emphasis.